

We Claim:

1. An ion source for a mass analysis system, said ion source comprising:

means for forming an electron stream;

an anode having an interior region into which said formed electron stream is injected, said electron stream terminating within the anode region and in which ions are formed; and

a releasable anode liner, said anode cover being insertable into said interior anode region and configured to receive said electron stream therein.

2. An ion source as recited in Claim 1, further including ion extraction means for extracting ions from said anode region.

3. An ion source as recited in Claim 2, including means for admitting at least one reagent gas from a process being monitored by said system.

4. An ion source as recited in Claim 3, wherein said at least one reagent gas is admitted axially with respect to a formed ion beam created by said ion extraction means.

5. An ion source as recited in Claim 1, wherein said releasable anode liner includes an interior surface where electrons entering said anode region strike and

deposit energy and onto which deposits can adhere from at least one of surface adsorbed species and gas phase species.

6. An ion source as recited in Claim 1, wherein said releasable anode liner includes electron entry means for permitting at least a portion of said created electron stream to enter said anode region when said liner is inserted therein.

7. An ion source as recited in Claim 1, wherein said electron entry means includes at least one lateral slot provided on said releasable anode liner.

8. An ion source as recited in Claim 1, including insertion and extraction means for permitting said releasable anode liner to be selectively inserted and removed from the anode region.

9. An ion source as recited in Claim 8, wherein said insertion and extraction means includes at least one attachment and removal slot provided on one end of said releasable anode liner, and an insertion/removal tool having at least one pin for engaging said at least one attachment and removal slot.

10. An ion source as recited in Claim 6, including means for aligning said electron entry means of said releasable anode liner with said electron stream forming means when a said liner is inserted into said anode region.

11. An ion source as recited in Claim 10, wherein said aligning means includes a reference feature provided on said anode, said reference feature being aligned with a portion of said insertion tool after a liner has been initially assembled thereto to provide indexing of said liner relative to said electron stream forming means when a said liner is assembled thereto.

12. An ion source as recited in Claim 1, wherein said liner comprises a sleeve-like member sized to fit within the interior of said anode.

13. An ion source as recited in Claim 1, wherein said electron stream forming means includes a heated filament.

14. An ion source as recited in Claim 1, wherein said anode liner is made from an electrically conductive material.

15. A replaceable anode liner for an ion source, said ion source comprising having means for creating an electron stream disposed in relation to the interior of an anode support structure, said liner being releasably engageable with said ion source and configured to fit within said anode support structure.

16. An anode liner as recited in Claim 15, including means for automatically indexing said replaceable anode liner relative to said electron stream producing means of said ion source when said liner is inserted into said anode structure.

17. An anode liner as recited in Claim 16, wherein said liner is a cylindrical sleeve member having a diameter that is sized to fit within the interior of said anode structure.

18. An anode liner as recited in Claim 17, wherein said liner is made from an electrically conductive material.

19. An anode liner as recited in Claim 18, including a first slot sized to permit electrons from said electron stream forming means to flow to the interior of said anode and the interior of said liner such that insulating deposit from entering reagent gases will adhere to the interior of said anode liner.

20. An anode liner as recited in Claim 19, including a second slot sized for engagement with a tool for selectively removing and inserting said liner relative to an ion source.

21. An anode liner as recited in Claim 20, wherein said second slot is substantially T-shaped for engagement with a pin of said tool, wherein the engagement of said second slot with said pin permits each of inserting and removing of a said liner relative to said ion source.

22. An ion source assembly for a gas analysis system, said assembly comprising:

an ion source including at least one filament, an anode structure having an interior region into which a formed electron beam from said filament enters, a gas port that permits the entry of process gases for analysis and a plurality of replaceable anode liners wherein an anode liner is insertable into the interior of said anode structure, each of said liners being made from an electrically conductive material and having means for permitting at least a portion of said electron stream to enter the interior of said anode structure.

23. An ion source assembly as recited in Claim 22, including means for extracting ions from said interior region of said anode structure.

24. An ion source assembly as recited in Claim 22, wherein said ion source is a closed ion source.

25. An ion source assembly as recited in Claim 22, wherein at least one of said replaceable anode liners includes an opening sized for permitting at least a portion of said electron beam to enter the interior anode region.

26. An ion source assembly as recited in Claim 22, wherein at least one of said replaceable anode liners includes a gas effusion port.

27. An ion source assembly as recited in Claim 25, wherein said opening is a lateral slot.

28. An ion source assembly as recited in Claim 22, wherein each of said anode liners controls the electrons entering said anode region, said ion source being useful in monitoring each of PVD and CVD processes.

29. An ion source assembly as recited in Claim 25, including means for automatically indexing the opening relative to said electron stream producing means when a said liner is inserted into said anode structure.

30. An ion source assembly as recited in Claim 22, wherein each of said replaceable anode liners prevent accumulation of surface deposits on the interior of said anode when inserted in the interior anode region of said ion source.

31. A method for improving the sensitivity of a contaminated ion source, said ion source including an anode structure defining an interior region, said interior anode region receiving an electron stream wherein ions are formed in said region, said method comprising the steps of:

inserting a replaceable anode liner into the anode structure such that said liner is disposed in said interior anode region and receives said electron stream, said liner being made from an electrically conductive material permitting insulating deposits from said electron stream to form on an interior surface thereof in lieu of the interior of said anode structure.

32. A method as recited in Claim 31, wherein said replaceable anode liner is a sleeve-like element, said inserting step includes the steps of:

placing one end of said replaceable anode liner onto one end of an insertion tool; and
inserting said liner into the anode structure.

33. A method as recited in Claim 32; further including the step of aligning an electron entry means of said releasable anode liner relative to an electron stream forming means of said ion source during said inserting step.

34. A method as recited in Claim 33, wherein said aligning step includes the steps of:

mounting one end of said replaceable anode liner to the end of an insertion tool, said mounting step including the additional steps of:

aligning a pin of said insertion tool with an assembly slot of said liner; and

slipping said liner over said insertion tool such that said pin is placed in said assembly slot; and

aligning said assembly pin with a reference feature provided on said anode structure wherein insertion of said liner automatically aligns the electron entry means of said liner with said electron stream forming means.

35. A method as recited in Claim 34, including the step of removing said liner after a predetermined time for replacement thereof.

36. A method as recited in Claim 35, wherein said removal step comprises the steps of:

aligning a removal tool with said liner such that a T-shaped slot of said liner is aligned with a pin of said removal tool;

rotating said tool about a center axis to permit said pin to engage said slot; and

axially removing said releasable anode liner from said anode structure.